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Laparoscopic cholecystectomy using endoloop ligation in a bitch with biliary disorders

Colecistectomia laparoscópica com ligadura endoloop em cadela com distúrbios biliares

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ABSTRACT: A 4-year-old female poodle presented with eosinophilia and increased alanine aminotransferase during routine evaluation. Ultrasound examination revealed findings suggestive of mild liver steatosis, biliary mucocele, cholelithiasis, and cholecystitis, and conservative treatment was indicated. Thirty days later, the patient had diarrhea, abdominal pain, and weight loss. Laboratory examination revealed thrombocytopenia, hyperbilirubinemia, and increased activity of alkaline phosphatase and alanine transaminase. Based on the progressive changes in the exams and the condition suggestive of moderate to severe cholecystitis, a laparoscopic cholecystectomy with an endoloop ligature was performed. The dog recovered from surgery and anesthesia without complications and was discharged the next day. Amoxicillin with clavulanate, meloxicam, dipyrone, and tramadol hydrochloride were prescribed as a postoperative drug. The patient's recovery was quick and uneventful. Laparoscopic cholecystectomy was efficient in the treatment of bile duct disease of this bitch and the use of an endoloop was shown to be efficient for sealing the bile duct in this case.

KEYWORDS: Biliary tract endosurgery; cholecystitis; cystic duct ligation; laparoscopic suturing.

RESUMO: Uma fêmea poodle de 4 anos apresentou eosinofilia e aumento da alanina aminotransferase durante avaliação de rotina. O exame ultrassonográfico revelou achados sugestivos de esteatose hepática leve, mucocele biliar, colelitíase e colecistite, sendo indicado tratamento conservador. Trinta dias depois, o paciente apresentou diarreia, dor abdominal e perda de peso. O exame laboratorial revelou trombocitopenia, hiperbilirrubinemia e aumento da atividade da fosfatase alcalina e da alanina transaminase. Com base nas alterações progressivas dos exames e no quadro sugestivo de colecistite moderada a grave, foi realizada colecistectomia laparoscópica com ligadura endoloop. O cão se recuperou da cirurgia e da anestesia sem complicações e recebeu alta no dia seguinte. Amoxicilina com clavulanato, meloxicam, dipirona e cloridrato de tramadol foram prescritos como medicamento pós-operatório. A recuperação do paciente foi rápida e sem intercorrências. A colecistectomia laparoscópica foi eficiente no tratamento da doença das vias biliares desta cadela e o uso do endoloop mostrou-se eficiente para o selamento da via biliar neste caso.

PALAVRAS-CHAVE: Videocirurgia das vias biliares; colecistite; ligadura do ducto cístico; sutura laparoscópica.

INTRODUCTION

Gallbladder diseases are increasingly prevalent in dogs, usually affecting older dogs (over 8 years), but can also be found in a wide age range (1.5 to 17 years) without apparent sexual predisposition (Kakimoto *et al.*, 2017; Piegols *et al.*, 2021). The biliary sludge formed in the gallbladder can progress to a mucocele with the presence of cholelith and obstruction of the bile ducts associated or not with cholecystitis incidentally diagnosed during abdominal ultrasound (Butler *et al.*, 2022).

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Clinicopathological abnormalities of biliary diseases vary according to their magnitude and the presence of concomitant comorbidities (Jaffey *et al.*, 2019). Clinical signs range from subclinical to severe manifestations and death (JAFFEY, 2022). Hyperbilirubinemia tends to be higher in dogs with more severe or progressive disease and pancreatic complications, obstruction of the bile duct, cholestasis, gallbladder rupture, or cholecystitis (Jaffey, 2022; Viljoen *et al.*, 2021).

Laparoscopic cholecystectomy is indicated for dogs with moderate to severe cholecystitis with concomitant biliary mucocele or in dogs with suspected biliary rupture or obstruction. Its performance by laparoscopy is indicated in simple cases and can provide better patient recovery with a lower morbidity rate (Scott *et al.*, 2016; Simon and Monnet, 2020). For this reason, it is necessary to use safe and effective methods for dissection and ligation of the cystic duct, to avoid complications and conversion to open surgery (Simon and Monnet, 2020; Kanai *et al.*, 2022).

Laparoscopic cholecystectomy has been performed in dogs with acceptable and promising results, with a single laparoscopic port, using conventional ligation methods with metal clips and dissection of the subserosal layer (Lovell *et al.*, 2019; Kondo *et al.*, 2022). The use of endoloop ligatures in the cystic duct is effective but requires that the duct be separated prior to placement (Lovell *et al.*, 2019; Kondo *et al.*, 2022). Therefore, the treatment of biliary diseases by laparoscopic cholecystectomy using endoloop ligation in the cystic duct should be better described in dogs. Therefore, the objective of this work is to describe a case of laparoscopic cholecystectomy using endoloop ligation in the cystic duct of a bitch presenting biliary mucocele with cholelith and cholecystitis.

CASE REPORT

A 4-year-old female poodle weighing 2.0 kg was referred for routine evaluation and check-up. At the initial referral evaluation, the physical examination findings were unremarkable and the owner did not report any clinical signs. In the blood count, the leukogram showed eosinophilia (value: 1560 cells/mm3; reference: 100 to 1250 cells/mm3) and the dosage of Alanine aminotransferase (ALT) activity increased slightly (value: 103.40 IU/L; reference: 10 to 78 IU/L). The results of the erythrogram and creatinine dosage were within the normal range for the species, without pathological alterations. Based on these results, silymarin-based supportive therapy (30 mg/kg, once a day, for 7 days) was recommended and the patient was referred for a full abdominal ultrasound.

Ultrasonography identified a diffuse increase in echogenicity of the liver parenchyma and gallbladder filled with heterogeneous content with a slight amount of hyperechoic material. Furthermore, a structure was identified in the transition region from the bladder neck to the cystic duct with circular contours that did not promote acoustic shadowing in dimensions of 0.86 cm x 0.52 cm x 0.84 cm. These sonographic findings suggest mild liver steatosis, biliary mucocele, cholelithiasis, and cholecystitis.

Despite the clinical changes suggestive of hepatobiliary pathologies, the patient was asymptomatic and, for this reason, silymarin-based drug treatment was indicated to reduce liver overload. Hepatobiliary changes were accidentally identified because the patient had no symptoms and were identified during a routine consultation.

Thirty days later, the patient returned to the hospital with diarrhea, abdominal pain in the right upper quadrant, and weight loss, without changes in heart rate, respiratory rate and rectal temperature. Blood count with dosage of liver enzyme activity (ALT and alkaline phosphatase - ALP), total protein and fractions, direct bilirubin, indirect bilirubin, urea, and creatinine was requested. The results showed thrombocytopenia (value: 50,000; reference: 200,000 to 500,000 mm3), with three macroplatelet crosses and one platelet aggregates; increase in direct bilirubin (value: 0.42 mg/dL; reference: 0 to 0.30 mg/dL); ALP (value: 260 U/L; reference: 20 to 150 U/L) and ALT (value: 137 U/L; reference: 10 to 125 U/L).

Taking into account the progressive changes in the exams, laparoscopic cholecystectomy was indicated.

The dog was premedicated with tramadol hydrochloride (4mg/kg, IM) and propofol (5mg/kg, IV) and midazolam (0.2 mg/kg, IV) was administered as a prenesthetic medication. Cephalexin (25 mg/kg, IV) was administered for perioperative antimicrobial treatment. Endotracheal intubation was performed in the patient and anesthesia was maintained. Anesthetic monitoring included ECG – Electrocardiography, oxygen saturation (spO2) through pulse oximetry, stethoscopic measurement of respiratory rate, and rectal temperature measurement with a clinical thermometer. The patient was placed in dorsal decubitus and the ventral region of the abdomen was prepared aseptically.

A three-port technique for laparoscopic cholecystectomy was used, where all trocars were inserted using the modified Hasson technique. To establish the laparoscopic portal, a 10mm skin incision was made in the ventral midline, approximately 1 cm cranial to the umbilicus, where a 10-mm smooth cannula-trochart with insufflation valve was inserted through which the CO2 pneumoperitoneum (10mm Hg) was established and a rigid 0 ° scope was inserted into the cannula after removal of the trocar. Two instrument portals were established under laparoscopic guidance in the right (5 mm) and left (10 mm) cranial abdominal quadrants, parallel, through which the bipolar and babcock forceps were inserted.

The liver and biliary system were inspected, evaluated for size, conformation, color, and macroscopic lesions, using tweezers and a rigid endoscope. The liver was enlarged, with rounded edges, whitish and diffuse spots in the parenchyma, and a redder color than normal (Figure 1A). The gallbladder and cystic duct were inspected and found to be enlarged. The gallbladder was placed in the hepatic fossa and then

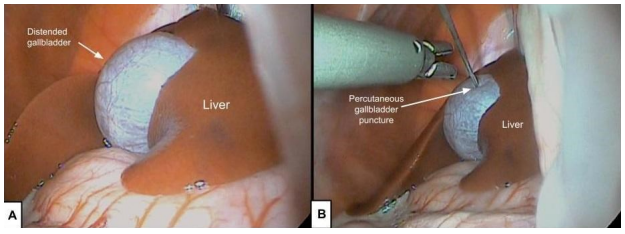
percutaneously punctured using a 20G catheter through which the bile was extracted and emptied from the organ to facilitate its intracavitary manipulation (Figure 1B).

The cystic duct and gallbladder were dissected from the liver parenchyma on both sides using bipolar forceps. Once the dissection was complete, the cystic duct was ligated with two Roeder-type endoloop knots using 0 nylon thread, one proximal and the other distal to the planned transection site (Figure 2). The cystic duct was sectioned with laparoscopic Metzenbaum scissors and the gallbladder was removed through the 10 mm minilaparotomy site without the use of a recovery bag, as the gallbladder had been punctured and was empty, without biliary contents (Figure 3).

Hemostasis of a small hepatic hemorrhage was performed during gallbladder dissection with bipolar forceps. The synthesis of the three minilaparotomy procedures was carried out routinely, after reversing the pneumoperitoneum, with a sultan suture pattern and a 3-0 polyglycolic acid thread. The total duration of the laparoscopic procedure was 125 minutes.

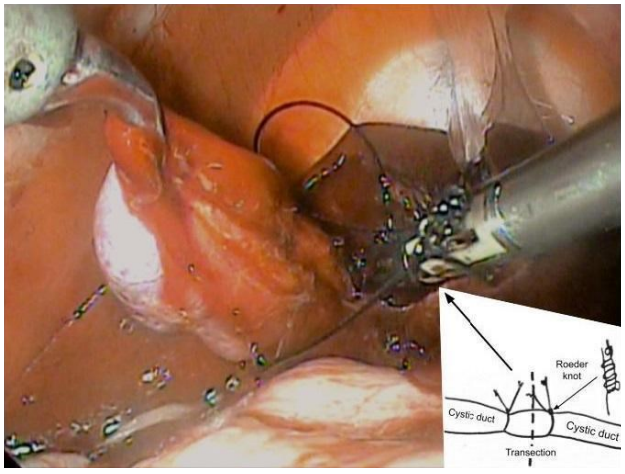
The dog recovered from surgery and anesthesia without complications and was discharged the next day. As postoperative medication, amoxicillin with clavulanate (20mg/kg, PO, every 12 hours for 7 days), meloxicam (0.2mg/kg, PO, every 12 hours for 3 days), dipyrone (25mg/kg , every 8 hours for 7 days) and tramadol hydrochloride (2mg/kg, every 8 hours for 7 days). Recovery from the procedure followed the normal course of healing and the dog did not present clinical signs or intercurrences related to biliary tract diseases.

Figure 1. Intrabdominal laparoscopic view of the distended gallbladder located between the hepatic lobes. A - Distended gallbladder in anatomical position. B - Video-assisted percutaneous cholecystocentesis.



Source: author's collection.

Figure 2. Double ligation of the cystic duct using an endoloop.



Source: author's collection.

DISCUSSION AND CONCLUSION

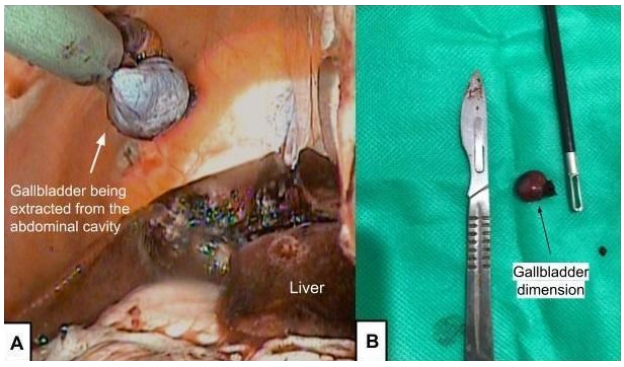
Diseases of the biliary tract are most often related to the gallbladder or obstruction of the bile ducts and are commonly diagnosed in dogs incidentally during ultrasound examination, as in the case reported (Piegols *et al.*, 2021; Butler *et al.*, 2022). Gallbladder diseases can be related to bile stasis with the formation of biliary sludge, cholelithiasis, obstruction, and even bacterial infections (Kakimoto *et al.*, 2017; Piegols *et al.*, 2021). Although the causes are mostly undetermined in situations like this, many cases may be related to hypomotility of the gallbladder and changes in bile acids produced (Demonaco *et al.*, 2016; Kakimoto *et al.*, 2017).

The cholecystitis in the present case may be related to the accumulation of biliary sludge and even the choleliths diagnosed during ultrasound, which can lead to a bacterial infection. The composition of the biliary sludge formed in dogs has higher levels of tau-roursodeoxycolic acid and lower levels of ursodeoxocholic glycocholic, cholic, and taurolithocholic acids. The levels of these components in the bile liquid can determine the formation of stones-infested biliary sludge in the bile, predisposing to gallbladder diseases (Kakimoto *et al.*, 2017; Jaffey, 2022).

Changes in liver function biochemical parameters may not occur in biliary tract diseases, but in this case, the changes were significant and noticeable, reinforcing the importance of monitoring liver function through the enzymatic dose of ALT and ALP. In addition to enzymatic changes in organ liver, the size can increase due to the thick bile inside, which can determine cases of hepatomegaly (Ward *et al.*, 2020; Mitsui *et al.*, 2021).

Sludge in the biliary tract usually does not cause severe complications, but in this case it is very likely that the clinical signs were related to the presence of biliary sludge and

Figure 3. Laparoscopic intraabdominal view of gallbladder exeresis. A - Exeresis of the gallbladder from the abdominal cavity. B - Gallbladder extracted from the abdominal cavity.



Source: author's collection.

cholecystitis. Asymptomatic cases are usually treated empirically; however, the most indicated therapy is cholecystectomy for patients who have clinical signs due to large amounts of biliary sludge with concomitant moderate to severe cholecystitis or biliary rupture or obstruction (Mizutani *et al*. 2017; Simon and Monnet, 2020; Kanai *et al*., 2022). Initial medical treatment was established because the patient was asymptomatic and aimed to promote liver regeneration (Wellington; Jarvis, 2001; Saller; Meier; Brignoli, 2001).

Elective cholecystectomy is a procedure with a low mortality rate and, when performed laparoscopically it can result in better patient recovery with fewer postoperative complications (Saller; Meier; Brignoli, 2001; Galley *et al*., 2022). The surgical time performed in this case was similar to the surgical time of the procedure performed by Kanai *et al*. (2018), who evaluated laparoscopic cholecystectomy with 4 portals and ligation of the cystic duct with metal clips in 76 dogs.

Compromised permeability of the bile ducts may reflect increased serum ALT and AST due to hepatocellular damage, but direct methods such as cholangiography can provide more accurate data on changes in permeability of these ducts, which may be another resource applicable in cases similar to this (Vergine *et al*., 2005; Alvarez; Whittemore, 2009; Kanai *et al*., 2022). For total sealing of the obstructed biliary tract, or even cystic duct ligation, in these cases of cholecystectomy, techniques such as surgical clips are used (Davidson; Moll; Payton, 2003), suture (Devitt; Cox; Hailey, 2005), combinations (Culp; Mayhew; Brown, 2009), vessel sealant device (VSD) and EndoclipsTM (Marvel; Monnet, 2014).

The use of intra and extracorporeal suture ligation to seal and transection of blood vessels and bile ducts can influence surgical time, especially when performed within the cavity, as it requires minimal training and is considered difficult and time consuming in some cases (Dumartinet *et al*., 2022; Sunghan *et al*., 2023). In this case, the pre-tied and extracorporeal sliding knot was performed without difficulty due to previous training, allowing the performance of the laparoscopic cholecystectomy in a timely surgical manner with efficiency in sealing the cystic duct.

Pre-tied slip knots can be quite advantageous and feasible in many procedures, ensuring proper sealing of blood vessels and ducts with fast and reliable transection (Martin *et al*., 2021). Extracorporeal knot pre-tied that was applied to the cystic duct after cholecystocentesis was found to be safe and feasible in this case of laparoscopic cholecystectomy.

The laparoscopic cholecystectomy performed in this case allowed good manipulation and visualization of the biliary tract within the abdominal cavity due to the magnificence of the image of these organs, providing an expanded surgical field (Park; Minamoto, 2021; Monteiro *et al*., 2022). Limitations related to the equipment, instruments, and training of the surgical team can make approaches like this difficult; however, they cannot be considered insurmountable.

Finally, laparoscopic cholecystectomy using extracorporeal sliding ligation was feasible in this case and needs to be further researched to develop new minimally invasive surgical techniques in the biliary tract of dogs. The use of laparoscopic suture ligation in the bile duct may be a sealing alternative that offers good sealing efficiency at low cost, which requires further related studies. Laparoscopic cholecystectomy was adequate for the treatment of this bitch biliary disease and the use of an endoloop was shown to be efficient in sealing the bile duct in this case.

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